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Originally published at:
Thomann, Johannes (2019). From katarchai to ikhtiyārāt : The emergence of a new Arabic document type combining ephemerides and almanacs. In: Nodar, Alberto; Torallas Tovar, Sofia. Proceedings of the 28th Congress of Papyrology Barcelona 1–6 August 2016. Barcelona: Primera edición, 342-354.

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in

Proceedings of the 28th Congress of Papyrology

Barcelona 1-6 August 2016

Edited by Alberto Nodar & Sofía Torallas Tovar

Coedited by María Jesús Albarrán Martínez, Raquel Martín Hernández,

Irene Pajón Leyra, José-Domingo Rodríguez Martín & Marco Antonio Santamaría

Scripta Orientalia 3

Barcelona, 2019

Coordinación y edición: Alberto Nodar – Sofía Torallas Tovar
Coedición: María Jesús Albarrán Martínez, Raquel Martín Hernández, Irene Pajón Leyra, José Domingo Rodríguez Martín, Marco Antonio Santamaría
Diseño de cubierta: Sergio Carro Martín

Primera edición, junio 2019

Ausiàs Marc 92-98 – 08013 Barcelona

ISBN 978-84-9191-079-4 (Pamsa)
ISBN 978-84-88042-89-7 (UPF)
Edición digital
http://hdl.handle.net/10230/41902

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Universitat Pompeu Fabra (Barcelona 2019) 342-354

From *katarchai* to *ikhtiyārāt*: The Emergence of a New Arabic Document Type Combining Ephemerides and Almanacs

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1. Ancient Hemerology, Greek *katarchai*, and Indian *muhūrta*

Hemerology looks back upon a long tradition in the Eastern Mediterranean region. Lists of lucky and unlucky days exist from the second millennium BCE onwards. A Hieratic papyrus found in Lahun is the earliest such list.[1] It is a calendar in which each day is either labelled as good (*nefer*) in black, or as bad (*dju*) in red, and three days are labelled as both good and bad. Hemerology was widespread. A Linear B document is the first example in the Greek language.[2] In the Greek and Roman world, hemerology was already well-established at an early date. But these practices were based on cultic or civil calendars.[3] In Hellenistic Egypt, a new system of astrological interpretation of planetary constellations arose, first in the form of horoscopic astrology, based on the moment of birth of an individual, later, in the 1st century BCE, in a new continuous form of astrology, the καταρχαί. The first Greek author known to have written on the subject was Dorotheos of Sidon (50-100 CE).[4] The Greek text is lost, but an Arabic translation survived.[5] The καταρχαί, literally the 'beginnings', were used to determine the best time to start a particular action. In the system of Dorotheos, the future planetary position was compared with the birth horoscope of the customer.

Astrologers used astronomical year-books, called ephemerides, which listed each day of a year, grouped by month, in different calendars, the positions of Sun, Moon, planets, lunar node, and eventually daylength and altitude of the sun at noon. Twenty fragmentary ephemerides on papyrus survived.

At first these were products of mathematical astronomy and chronology without any reference to astrological concepts. This changed in the 5th century CE. In three ephemerides of this time, we find an additional column with astrological content. In P.Oxy.Astr. 4180 (465 CE), the astrological nature of the zodiacal sign of the moon is mentioned as solid, bicorporal and tropical. The quality of the day is described as bad, mean, unlucky, and in the lost part probably good.[6]

P.Vind. inv. 29370 (489 CE) lists the qualities 'good', 'bad', 'without entourage' and 'ecliptical',[7] P.Mich. inv. 1454 (467 CE) 'good', 'bad', 'mean' and 'ecliptical'.

Hellenistic astrologers were successful missionaries of their discipline, noticeable as far as India. In the *Yavanajātaka* («Nativity of the Greek»), Greek and Indian astrology were merged.[8] Two chapters are devoted to the καταρχαί, which were called *muhūrta*, literally

[1] UC 32192; Szpakowska (2010) 523; Collier / Quirke (2004) 26-27.
[2] Tn316; Ventris / Chadwick (1973) 284-286.
[3] Salzman (1990) 1-16.
[4] Jones (2008).
[5] Pingree (1976).
[6] Jones (1999) i 190-191, ii 192-199.
[7] Gerstinger / Neugebauer (1962); Jones (1994); Kreuzsaler (2015).
[8] Pingree (1978); Mak (2014) 1104.

'moment, short space of time'.[9] A similar topic was military astrology, called *yātrā* 'expedition', also contained in the *Yavanajātaka*.[10] This branch of astrology had no Greek prototype but was based on earlier Indian literature on *omina*. In the same work, a new technique of interrogations, *praśnajñāna*, 'science of question', was developed: the question of a customer was to be answered based on a horoscope cast for the time of asking.[11]

2. The *katarchai/muhūrta/ikhtiyārāt* in Arabic Astrological literature

Sanskrit works on astronomy and astrology were among the first scientific texts which were translated into Arabic in mid 8th century.[12] Another line of transmission were translations from Pahlavī into Arabic.[13] Besides the work of Dorotheos of Sidon, for example, the Anthologiae of Vettius Valens (120-184 CE) were translated from a Pahlavī version into Arabic. From the latter, a quotation concerning the καταρχαί is found in the *Kitāb al-Bāriʾ* of Ibn Abī l-Rijāl.[14] In the first half of the 9th century CE, Greek astrological works were translated into Arabic. The Tetrabiblos of Ptolemy had the greatest impact on Arabic astrology, but it only remarks occasionally on the καταρχαί. An early Arabic work on the *ikhtiyārāt* was written by Sahl Ibn Bish (c. 786-845 CE).[15] It is arranged by astrological houses, which was not the case in book five of Dorotheos of Sidon, which was organised by human activities like building a house or buying a slave. Sahl's example was influential, and the arrangement by astrological houses is found in the *Madkhal* of Kūshyār Ibn Labbān and the *Kitāb al-Bāriʾ* of Ibn Abī Rijāl.[16] The *ikhtiyārāt* were highly relevant in ordinary life, possibly higher than birth astrology. Historical accounts refer to events in which leading political figures coordinated their actions according to those astrological prognoses.[17] Most prominent was choosing the right time for the founding of Baghdad in 762 CE.[18]

3. Arabic Documentary Evidence for the *ikhtiyārāt*

The earliest documentary evidence of the *ikhtiyārāt*, as the καταρχαί were called in Arabic, is an almanac (fig. 1), P.Berol. inv. 12793 (910 CE).[19] The fragment was part of a bifolium. The type of page layout has no resemblance with any Greek astronomical document. A single page covered the data for five days. The first of the three columns shows the zodiacal signs of the sun and the planets. The middle column lists the date, the moon's position in degrees, the aspects of the moon and the astrological interpretation. In the last column the position of the moon in the lunar mansions, the time of dusk and the dates in the Persian, Roman, and Coptic calendar.

[9] Pingree (1978) ii 183-186, 402-405; Pingree (1981) 101-107.
[10] Pingree (1978) ii 174-183, 388-402; Pingree (1981) 107-108.
[11] Pingree (1978) ii 132-174, 370-388; Pingree (1981) 110-114.
[12] Thomann (2014b) 505-509.
[13] Pingree (1997) 39-62.
[14] Nallino (1922) 353.
[15] Crofts (1985).
[16] Kūshyār (1997) 236-261; Aly Aben Ragel (2005) 87-190; Albohazen (1551) 269-351.
[17] Nallino (1939-1948) 5: 38-40; Fahd (1966) 483-488.
[18] Ibn al-Faqīh al-Hamadhānī (1996) 291; al-Bīrūnī (1879) 262.
[19] Thomann (2017).

Fig. 1 P.ThomannAlmanac (910 CE) Ägyptisches Museum und Papyrussammlung, Staatliche Museen zu Berlin, SPK. Photo: Sandra Steiß.

The astrological indications are more specific than those found in the Greek ephemerides. They touch on medical treatment, or the choice of important people to be addressed, topics which are common in astrological manuals. Obviously, these interpretations are based on the aspects of the moon with the sun and the planets. The aspects, σχήματα in Greek, *munāẓarāt* in Arabic, are opposition, trine, quadrature, sextile and –not counted among the aspects– conjunction. Opposition was associated with enmity, trine with compatibility, quartile with antagonism, sextile with friendship, while conjunction was considered neutral.[20] In Indian astrology, the course of the moon through the lunar mansions was used in military astrology to determine a favorable time for a military expedition. It may well be that the indications in the third column of the moon's position in the lunar mansions served the same purpose. The unusual zig-zag ornament which divides the columns is a style element in Sassanid pottery. As it seems, this document is a surviving example for an almanac in the Indo-Iranian tradition.

There is another similar example of an almanac P.Stras. inv. Ar. 419 (934/935 CE).[21] Within it, the right column corresponds to the middle column in the previous document. It contains the date, the zodiacal sign of the moon, its aspects and astrological interpretations. Additionally, the time for the particular events is recorded in hours.

In contrast to these two almanacs, the earliest Arabic ephemeris is very similar in layout to the ancient Greek ephemerides (fig. 2): P.ThomannEphemeris 931 (931/932 CE).[22] Calendrical columns, followed by columns for sun, moon, planets, lunar node, solar altitude at noon and daylength. However, there is no column for astrological indications. This seems to have been the standard, as four later ephemerides indicate (fig. 3-6): P.ThomannEphemeris 954 (954/955 CE), P.Vind. inv. A.Ch. 13577 (994 CE), P.Vind. inv. A.Ch. 32363 (1002 CE) and P.ThomannEphemeris 1026 (1026/1027 CE).[23]

[20] Abū Ma'shar *Abbreviation* III.10, Burnett / Yamamoto / Yano (1994) 41.
[21] Thomann (forthcoming).
[22] Thomann (2015a).
[23] Thomann (2013); Thomann (2014a); Thomann (2015c); Thomann (2015d); Thomann (2015e); Thomann (2015f); Thomann (forthcoming).

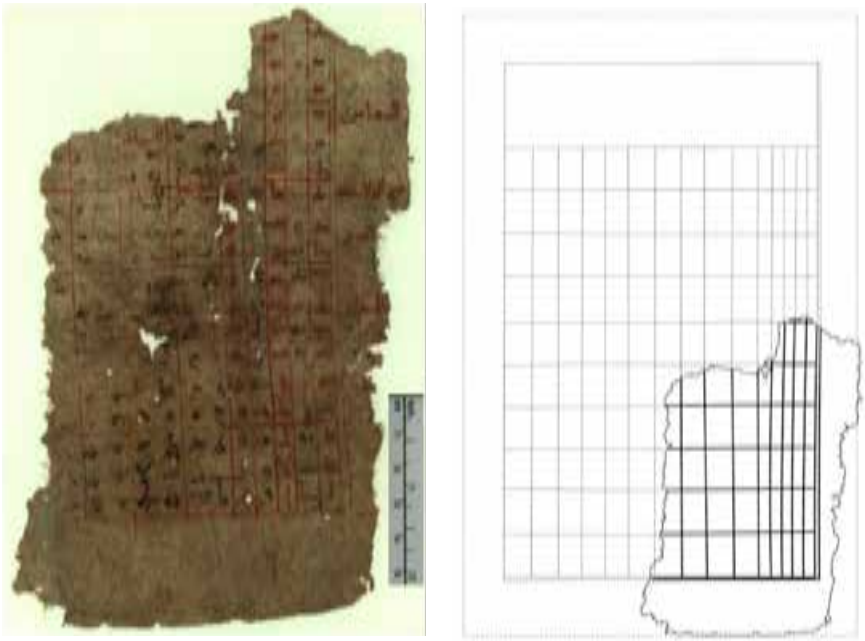

Fig. 2 P.ThomannEphemeris 931 (931 CE)

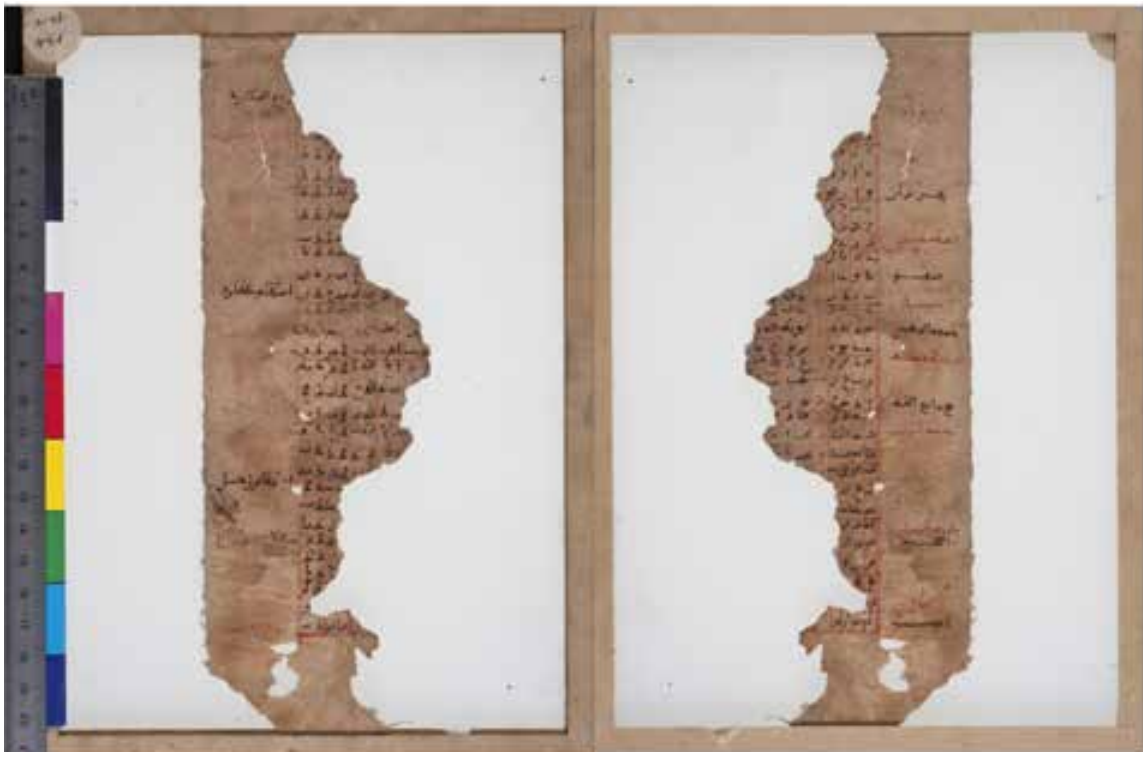

Fig. 3 P.ThomannEphemeris 954 (954 CE)

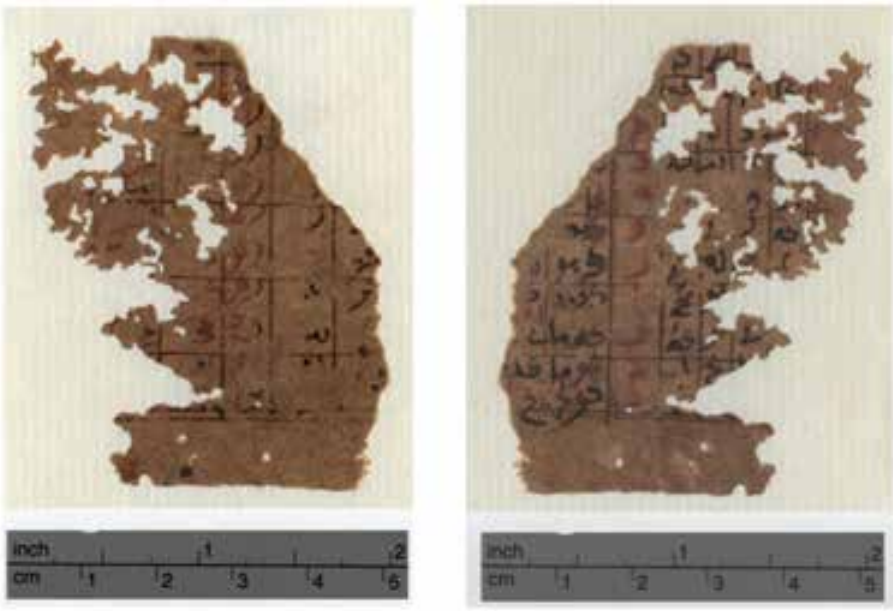

Fig. 4 P.Vind. inv.A.Ch. 13577 (994 CE)

Fig. 5 P.Vind. inv. A.Ch.32363 (1002 CE)

Fig. 6 P.ThomannEphemeris 1026 (1026 CE)

4. The Underlying Theory of the *ikhtiyārat* in Documents

The procedures which led to the astrological interpretations in the Arabic ephemerides and almanacs are not described in the standard manuals on astrology, but there is a very short treatise attributed to al-Kindī which describes in brief terms the method how to compile such daily recommendations of actions.[24] Depending on the aspects of the moon with the sun and the planets, actions which correspond with the planets' character are recommended. No warnings are given, since only the harmonious aspects trine and sextile are taken into consideration.

The actions which are recommended by al-Kindī appear very similar in the almanacs and ephemerides. In the almanac for 1149/1150 CE for instance (fig. 7), the moon in sextile to the sun is said to be favorable for speaking to the king, and the same is found in al-Kindī. Moon in sextile to Mercury is said to be favorable for speaking to the secretaries, a statement also found in al-Kindī. In the case of Mercury, the harmonious aspect of sextile is crucial. If the moon is in opposition to Mercury, it is said to be unfavorable for speaking to the secretaries. In contrast, when the moon is in opposition to benevolent Jupiter, the recommendation is favorable for drinking medicine. The same is found in al-Kindī, but restricted to sextile and trine. The underlying implications of the almanacs' and ephemerides' interpretations seem to be the following: Aspects to benevolent planets are always good. Harmonious aspects to the other planets are also good. Only inharmonious aspects to the non-benevolent planets are bad. The entire system is a straightforward combination of standard elements in astrology.

A Greek text "On ephemerides" of unknown origin has been found, transmitted together with Theon's Commentary on Ptolemy's Handy tables, which contains a passage on how to derive the general καταρχαί (καθολικαὶ καταρχαί) from the moon's aspects with the planets.[25] The text was probably written in the 5th century CE.[26] The rules differ from the rules of al-Kindī. But the judgments ἀγαθή and φαύλη correspond to those found in the ephemerides. It remains to be seen if the rules apply to the data in detail. There is another similar Greek text in a Paris MS.[27]

5. The Social Context of the *ikhtiyārāt*

None of the documents mentioned so far were found during a regular excavation. Documents from the Geniza were displaced from where they were used. All the more important is a note in the final report of the al-Fustat excavation in 1980. A document described as astrological responses was found in room IV-6B.[28] The house to which this room belongs is part of the worker's quarter. These houses are characterized by a lack of ornaments and highly unstable construction. Their inhabitants must have belonged to an underprivileged class of people in comparison to inhabitants of other quarters in al-Fustat. The fact that an astrological document was found at such a place indicates that astrology was not restricted to the elite or a bourgeois milieu but found its way to the houses of the proletarians.[29]

[24] MS Leiden UB, Or. 199; German translation: Wiedemann (1912).
[25] Delambre (1817) 635-637; Halma (1825) 38-42; Curtis / Robbins (1934) 83; Tihon (1978) 359.
[26] Personal communication by Alexander Jones.
[27] MS BnF gr. 2425 (unpublished); I owe this information to Alexander Jones.
[28] Richards (1989) 68.
[29] Scanlon (1997) 367.

Fig. 7 P.ThomannEphemeris 1149 (1149 CE) © Cambridge University Library

6. The Emergence of a New Type of Document Containing *ikhtiyārāt*

A new type is presented in the ephemeris (fig. 8) P.Vind. inv. A.Ch.1252 + P.Vind. inv. A.Ch.14324 (1044/1045 CE).[30] The astrological part occupies an entire page facing the page with the astronomical data. For each month, a double page features the astronomical data on the right and the astrological data on the left. The left page has a title with the word *ikhtiyārāt*, written in eastern Kufi. One can assume that there was at least an additional column to the right for the identification of the day.

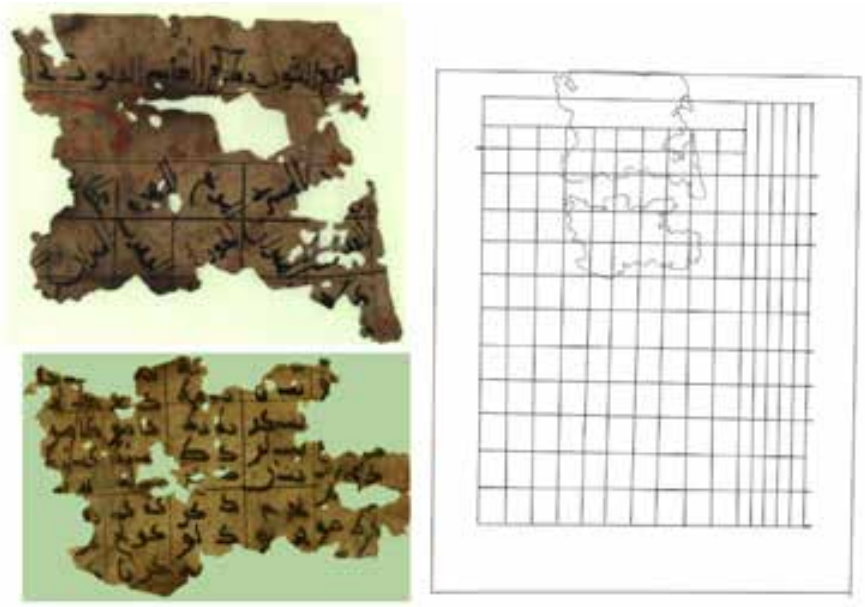

Fig. 8 P.Vind. inv. A.Ch.1252 + P.Vind. inv. A.Ch.14324 (1044 CE)

An entire folio of an ephemeris (fig. 7) P.Cambridge UL inv. Michael. Chartae D 58 (1149/1150 CE) allows us to reconstruct the layout of a double page of this type.[31] The main title is The elections of the days (*ikhtiyārāt al-ayyām*). Above it, two lines indicate the Arabic calendar, the lunar mansion and the lunar latitude. The two columns to the right contain the names of the weekdays and the moon as the subject of the phrases in the third column. This wide column contains the astrological data, the zodiacal sign of the moon, the aspects, their time and the astrological interpretation. Some interpretations are general, like auspicious, inauspicious or mixed. Others are more specific, like inauspicious for speaking to the secretaries, auspicious for acquiring and dressing in new clothing, or [auspicious] for addressing women and eunuchs. If no aspects correspond, the standard phrase is «a day of rest, quietness, and comfort». This means ‘don’t do or begin anything important’.

All documents shown so far were found in Egypt, but there are two unpublished fragments of an ephemeris for 1182/1183 CE, which was produced for a geographical latitude far north of Egypt. The fragments were found in a bookbinding, but no information of their origin is available. They are kept in the Islamisches Museum in Berlin (no inventory number). The layout of its astrological part is more complex. The first column contains the lunar mansions, the second the time when the moon enters a new zodiacal sign, and the third the zodiacal sign. The fourth column is filled with single letters and a few words like ‘before’, ‘morning’, and ‘dawn’, which seem to indicate the time during the day. The single letters are

[30] Thomann (2015g); Thomann (forthcoming).
[31] Thomann (2015b).

abbreviations for the planets and the aspects, using the last letter respectively. The same holds true for the fourth column, which contains data for nighttime. No astrological interpretation is given. A similar system of abbreviations is found in the almanac NJS ENA 2982.14 (1233/1234) from the Cairo Geniza (unpublished). In that case, the zodiacal signs and the times of the aspects are indicated by Indian numerals.

In contrast to ephemerides, almanacs do not contain the daily positions of the Sun and the planets, but rather give the zodiacal sign of the moon for each day. The almanac (fig. 9) P.Vind. inv. A.Ch. 1488 (990/991 CE) is a predecessor for the later almanacs in the Geniza.[32] The layout of its pages is as follows: the first 16 days of a Coptic month in a two-column table on the right, and the remaining 14 days in another two-column table on the left. The first column contains the name of the weekday, and the second the zodiacal sign of the moon, the planetary aspects and astrological judgments.

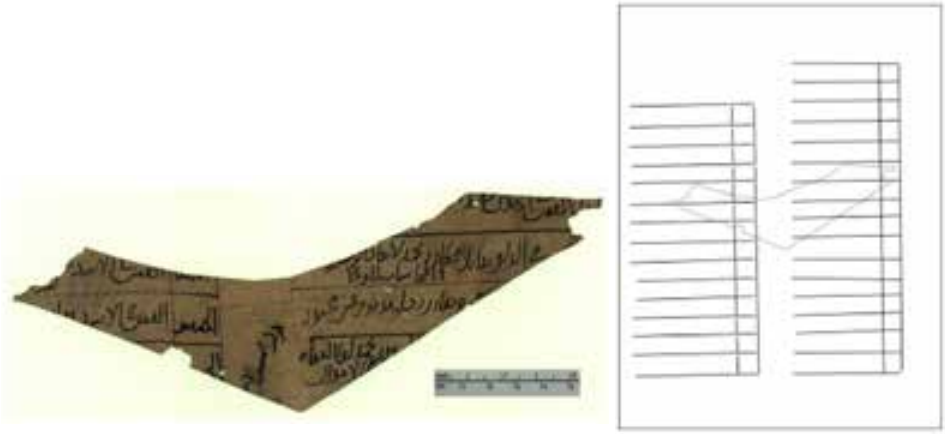

Fig. 9 P.Vind. inv. A.Ch. 1488 (990 CE)

In the almanac PSI. inv. Arab. ins. 5-325a (1128/1129 CE) the layout has changed to one table with thirty rows for the days of a month (unpublished). One column contains the days of the week, the second the word moon, as the subject of the phrases following in column three, which features the zodiacal sign, the aspects with their times of the day and the astrological interpretation. It resembles the oldest almanac from the Geniza T-S Ar. 41:103 (1131/1132 CE).[33] This underlines the cross-cultural character of astrology.

7. The Later History of the New Document Type and its Transmission to the West

This new type became the standard format in the Islamic world, as can be seen in the earliest completely preserved astronomical yearbook of 1329 CE, produced in Yemen.[34] In the Ottoman Empire, it remained standard format with minor alterations until the 19th century.[35] The format was used in a Byzantine Almanac for Trebizond in the year 1336 (fig. 10), again with one page for the astronomical data of one month, and the facing page with the καταρχαί.[36] The same format was also adopted in medieval Western Europe. A Latin ephemeris of the 13th century CE (fig. 11) has exactly this style (MS Paris, BnF lat. 16210) (unpublished).

[32] Thomann (2015h).
[33] Goldstein / Pingree (1979) 155-161.
[34] King (2004) 421.
[35] Kurz (2007); Kut (2007) 199-279; (2012) 517-536; Orthmann (2013) 46.
[36] Mercier (1994).

The same layout also continued to be used in the age of printing. It is still found in the Ephemerides of Johannes Kepler (fig. 12).[37]

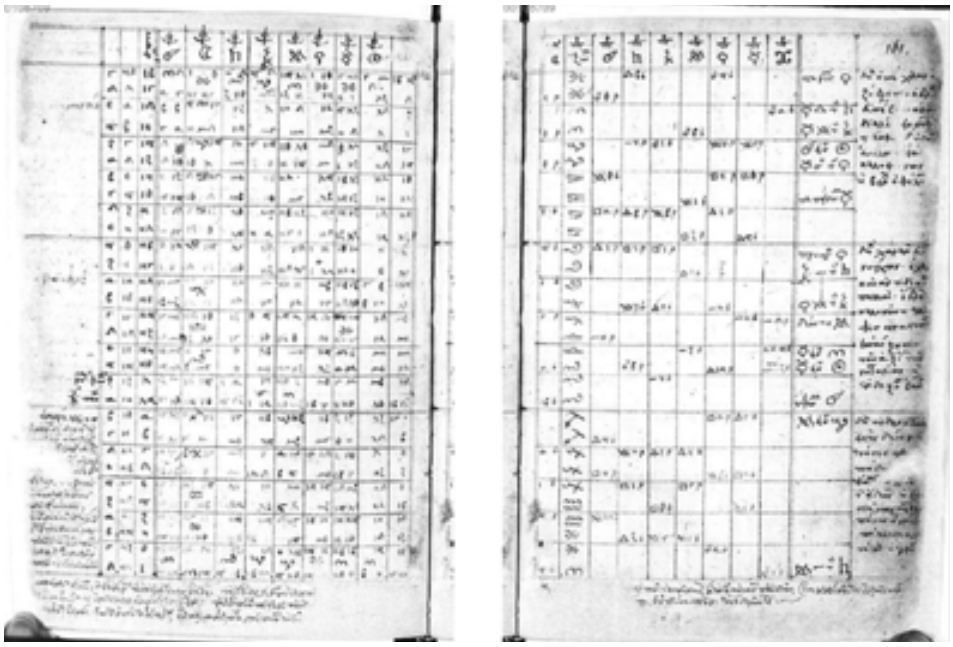

Fig. 10 MS Munich BVB cod. graec. 525. Source: www.digitale-sammlungen.de

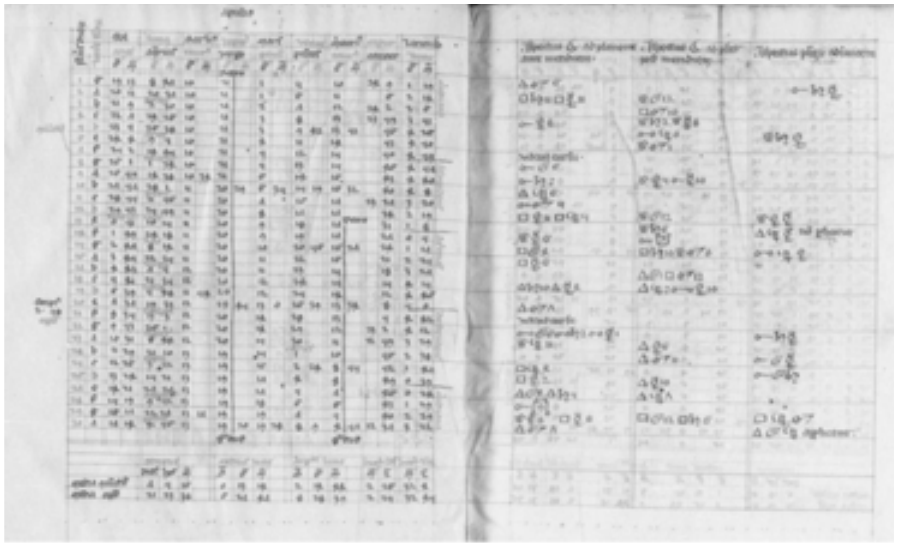

Fig. 11 MS Paris, BnF lat. 16210. Source: gallica.bnf.fr/BnF

8. Conclusion

The Arabic revival of Greek astronomy and astrology was both an act of tradition and an act of innovation. Greek type ephemerides reappeared after a break of five centuries in Islamic Egypt. At about the same time, almanacs of the Indo-Persian tradition were in use. In the 11th century a new document type combining the layout typical to ephemerides with that to almanacs with the *ikhtiyārāt* on a double-page was created. This new type became the standard format in the Islamic world until the end of the Ottoman Empire. The same type was also adopted in medieval Western Europe, and continued to be the standard format in the age of printing up to the 17th century. The double-page layout with ephemerides on the left side

[37] Kepler (1617).

and the astrological aspect on the right side illustrates that modern European science was only in part based on Greek scientific tradition. It was in equal parts based on Arabic tradition.

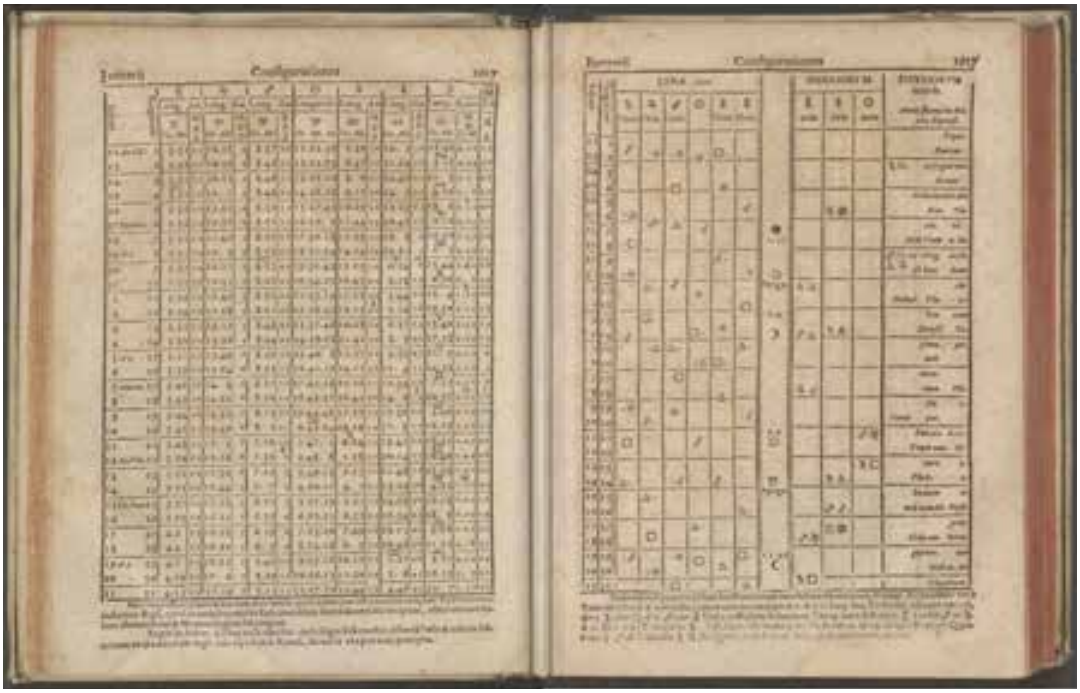

Fig. 12 Johannes Kepler, Ephemerides 1617

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